Effects of Doping Elements in beta-FeSi2 Prepared Utilizing Cast Iron Scrap Chips

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Abstract

In this work, the thermoelectric properties of p- and n-type beta-FeSi2, prepared utilizing cast iron scrap chips, have been characterized by measuring the Seebeck coefficient, electrical conductivity and thermal conductivity at temperatures ranging from room temperatures to 800 degrees C. In a previous study, the upgrade recycling of cast iron scrap chips into beta-FeSi2 thermoelectric materials was proposed as an eco-friendly and cost-effective production process. By doping with different substitution concentrations of Co, Mn and Al, the conduction type and properties of beta-FeSi2 can be modified and improved using cast iron scrap chips as a starting material. The effects of the doping elements are discussed for preparing beta-FeSi2 utilizing cast iron scrap chips. Cast iron scrap chips could be preferable as a starting material to replace pure Fe for n- and p-type beta-FeSi2 thermoelectric materials. An optimum composition for n-type beta-FeSi2 0.94C.I.-0.06Co-1.86Si shows that the largest ZT value of 0.22 occurs at 700 degrees C, whereas for p-type beta-FeSi2 0.92C.I.-0.08Mn-1.86Si, the largest ZT value of 0.17 occurs at 800 degrees C.

Keywords

Author Keywords: materials recycling; cast iron scrap chips; thermoelectric performance; beta-FeSi2
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